Tech Fact Sheet

Savannah River Site ***South Carolina***

3-D Model for Deactivation & Decommissioning

Challenge

Planning for the safe and controlled deactivation and decommissioning (D&D) of highly contaminated nuclear facilities requires that engineers and managers fully understand the work space in which personnel and equipment will operate. It also requires that they effectively communicate safety concerns and work sequences to the personnel who will perform the work. This crucial knowledge is conveyed in the work package, a descriptive work document which traditionally contains 2-dimensional facility construction drawings and photos with written descriptions, which supervisors and workers must then translate to the 3-D world in which the work is done. Both those planning the work and those physically executing it need a "3-D tool" which more precisely depicts the work environment. Such a tool would reduce uncertainty and interpretation, thus expediting accomplishment of the work, minimizing hazard exposure to workers, reducing safety risks, and precluding inadvertent insult to the environment.

Technical Solution

The design and production of 3-D scale models that replicate the highly contaminated structures within the nuclear facility would provide a significant improvement in visualization of the work space, which would give managers and supervisors a more powerful tool for planning and communicating safety issues and work sequences to personnel executing the physical D&D tasks. These types of models have traditionally been constructed as physical "mock-ups".

This model was produced at 1/96 scale, resulting in a 4' X 8' model.

Tech Accomplishments

Savannah River National Laboratory's (SRNL) computer-aided design (CAD) and rapid prototyping staff researched historical prints and drawings to obtain the "as-built" configuration of the nuclear facilities which were then entered into a 3-D CAD system. Rapid prototyping automates the translation of CAD drawings into 3-D models which then transmits the digital data to a 3-D printer which is essentially a high-tech glue gun. Plastic wire is fed to a computer controlled nozzle which reads the CAD data and extrudes melted plastic very precisely to create a replicate scale model of the facility. The SRNL team created 3-D models of structures within the R reactor building (1/96 scale) and the P reactor vessel (1/8 scale). A wide variety of sources exist with rapid prototyping capabilities at a number of DOE sites as well as a wide range of sources for commercial equipment and services on a consulting basis.

Site Project & Identifier	
In-Situ Decommissioning:	SR09171
SRS Area Closure Projects:	PBS SR-0040

Tech Stage: Deployment
3-D models of the R reactor building and P reactor vessel were delivered to SRS Area Closure Projects

Impact

3-D models have become a focal point for work discussions by the R and P Reactor Project teams. The models provide an opportunity to more efficiently test out work sequences and safety concerns prior to task execution, which in turn reduces uncertainty in the planning and work evolution. This was highlighted when the R reactor building 3-D model identified previously unknown void areas in deep sections of the facility, and that discovery changed the sequence of grouting to ensure the deep voids were filled prior to grouting higher levels. Once the virtual and real models existed, additional unexpected benefits of the models were realized. These have included: higher resolution atmospheric models to assist in evaporator placement and operation, a reduction in walk downs for stakeholder project familiarization, and rapid calculation of grout pour volumes for daily planning. Success with the early use of the 3-D models has resulted in this tool becoming a standard baseline approach for Savannah River Site (SRS) managers and supervisors who are planning deactivation and decommissioning work in highly contaminated nuclear facilities. 3-D models are now being developed to assist with the planning to decontaminate and disassemble the Plutonium Fuel Form (PuFF) Facility at the SRS.

Impact and Features

- Virtual (computer) 3-D model ties hundreds of drawings together in one easy to understand location.
- Anyone, not just engineers with CAD access, can query the models for simple information such as dimensions.
- Visualization of past process operations or D&D operations are color-coded to ID work evolution or safety concerns.
- Rapid prototype equipment builds plastic 3-D models at any level of detail and scale for jobsite briefings.
- Waste components can be classified by material type for rapid compilation of volume or mass.
- Enhance design and planning, such as robotic parts to fit the ports and space within glove boxes and cells.

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Technology Name	*3-D Model for D&D*
Federal End User Information	Ray Hannah SRS Closure Projects george.hannah@srs.gov
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Web Links	http://www.em.doe.gov/pdfs/2010sr06.pdf http://www.em.doe.gov/PDFs/DOE_EM_Feb_2010_web.pdf
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Challenge Category	Tech Solution Category
Deactivation Dismantlement	Planning & Design Computer Modeling